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Trehalose protects the corneal epithelium in alcohol delamination: a structural and ultrastructural study

Domenico Puzzolo[1], Antonio Micali[1], Antonina Pisani[1], Pietro Colosi[2], Pasquale Aragona[2] and Anna K. Nowińska[3]

[1] Department of Biomorphology and Biotechnologies, University of Messina, Messina, Italy
[2] Department of Surgical Specialties, Section of Ophthalmology, University of Messina, Messina, Italy
[3] Department of Ophthalmology, District Railway Hospital, Katowice, Poland

During laser subepithelial keratomilieusis (LASEK) the corneal epithelium undergoes to peculiar morphological changes owing to the dilute alcohol used to facilitate its mechanical separation from the stroma. As it was shown that trehalose, a non-reducing disaccharide of glucose, protects corneal epithelial cells from drying [1] and is effective in the treatment of experimental [2] and of human dry eye [3], aim of the present work was to evaluate the advantages of a pretreatment with trehalose to improve the structural and ultrastructural features of the corneal epithelium. Twelve patients undergoing LASEK were consecutively included in the study and treated as follows: topical anesthesia with oxybuprocaine hydrochloride 0.4 %, 20% ethanol in distilled water for 25 seconds followed by Merocel wetting, treatment with hypotonic BSS in distilled water, lifting of the epithelial flap with a beaver blade, excimer laser treatment (0.8 mm flying spot), reposition of the epithelial flap, BSS wash of the entire surface, application of a contact lens for 5-7 days. The right eyes of each patient were pretreated, together with the anesthetic, with 3% trehalose eye drops, whilst the left eyes were used as controls. Small parts of the epithelium were collected with a forceps at the end of the epithelial reposition and were processed for light and transmission electron microscopy. From the micrographs obtained with both techniques a morphometric analysis was also performed. In the controls, the corneal epithelium showed flat superficial cells with well-preserved apical microfolds, wing cells with intracellular vesicles and slightly dilated intercellular spaces, and irregularly shaped basal cells filled with vesicle, separated by wide spaces. In the trehalose-treated epithelium superficial cells showed normal shape, regular apical microfolds and well-preserved intercellular borders; wing cells had a well evident cytoskeleton, sometimes apparently double nuclei and normal intercellular borders, glued by desmosomes. The basal cells demonstrated polygonal shape, round nuclei and evident intracytoplasmic vesicles. The morphometric analysis carried out on the height and on the number of the layers of the corneal epithelium demonstrated in the trehalose-treated group values significantly lower than the control group. Similarly, basal hemidesmosomes were more numerous in the trehalose-treated group when compared to the control group. The morphological changes of the corneal epithelium during LASEK represent a simple and reproducible experimental model to evaluate the antagonists of an acute stress, such as the alcohol delamination. Our results demonstrate that trehalose administration before LASEK is able to maintain better morphological and morphometric features when compared to the control cornea.

References

[1] Matsuo T. (2001) Trehalose protects corneal epithelial cells from death by drying. Br J Ophthalmol 85:610-612.
[2] Li J et al. (2012) Therapeutic efficacy of trehalose eye drops for treatment of murine dry eye induced by an
intelligently controlled environmental system. Mol Vis 18:317-329.
[3] Matsuo T et al. (2002) Trehalose eye drops in the treatment of dry eye syndrome. Ophthalmology 109:2024-2029.

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